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(54) ALUMINUM ALLOY SHEET FOR FORMING EXCELLENT IN FORMABILITY AND ITS PRODUCTION

(57)Abstract:

PURPOSE: To provide an Al alloy sheet of Al-Mg series for forming excellent in formability, particularl in deep drawability.

CONSTITUTION: This Al alloy sheet is the one having a compsn. contg. 2.0 to 9.5% Mg, furthermore contg. one or two kinds of 0.01 to 1.5% Cu and 0.05 to 2.5% Zn, moreover contg., at need, one or mo kinds among 0.01 to 0.7% Mn, 0.01 to 0.3% Cr and 0.01 to 0.3% Zr, and the balance substantial Al, an in which the average r-value is regulated to ≥0.75 and I111/I200, i.e., the ratio of the diffraction intensi ratio I111 on the (111) plane to the diffraction intensity ratio I200 on the (200) plane is regulated to ≥ 0.25. Moreover, at the time of its production, in rolling till the final sheet thickness after hot rolling, warm rolling in the range of 350 to 100°C at ≥30% draft is executed.

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CLAIMS

[Claim(s)]
[Claim 1] 2.0 - 9.5% (it is below the same wt%) of Mg is contained. 0.01 - 1.5% of and Cu(s), One sort in 0.05 - 2.5% of Zn or two sorts are contained, and the remainder consists of aluminum and an unescapable impurity. An average Lankford value or more by 0.75 And field diffraction intensity ratio I111 to the pure aluminium powder (111) by the X diffraction Field (200) diffraction intensity ratio I200 A ratio I111 / I200 Aluminum alloy plate fo fabricating operations excellent in the moldability characterized by being 0.25 or more.
[Claim 2] Contain 2.0 - 9.5% of Mg, and one sort in 0.01 - 1.5% of Cu(s) and 0.05 - 2.5% of Zn or two sorts are contained. Furthermore one sort in 0.01 - 0.7% of Mn, 0.01 - 0.3% of Cr(s), and 0.01 - 0.3% of Zr or two sorts or more are contained, and the remainder consists of aluminum and an unescapable impurity. An average Lankford value or more by 0.75 And field diffraction intensity ratio I111 to the pure aluminium powder (111) by the X diffraction Field (200) diffraction intensity ratio I200 A ratio I111 / I200 Aluminum alloy plate for fabricating operations excellent in the moldability characterized by being 0.25 or more.
[Claim 3] While containing 2.0 - 9.5% of Mg, 0.01 - 1.5% of Cu(s), One sort in 0.05 - 2.5% of Zn or two sorts ar contained, and the need is accepted further. 0.01 - 0.7% of Mn, One sort in 0.01 - 0.3% of Cr(s) and 0.01 - 0.3% Zr or two sorts or more are contained. Since the remainder casts the alloy which consists of aluminum and an unescapable impurity and homogenizes to an ingot, after hot-rolling, It rolls out including warm rolling of 30% o more of reduction of sectional area at least. up to the last board thickness -- rolling out -- hitting -- the temperatur within the limits of 350-100 degrees C -- Furthermore, the last annealing is performed to the rolled plate of the la board thickness. Field diffraction intensity ratio I111 to the pure aluminium powder (111) an average Lankford value is 0.75 or more, and according to an X diffraction Field (200) diffraction intensity ratio I200 A ratio I111 / I200 It is characterized by obtaining 0.25 or more plates. The manufacture approach of the aluminum alloy plate fabricating operations excellent in the moldability.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the aluminum alloy plate excellent in especially reinforcement a a moldability, and its manufacture approach about the aluminum alloy plate for fabricating operations used for th components of various transportation-by-land cars, such as the body of an automobile, a chassis, a panel of an electrical machinery and apparatus, etc.
[0002]
[Description of the Prior Art] Although cold rolled sheet steel was conventionally used for the body sheet of an automobile in many cases, recently, using an aluminum alloy plate is advanced from the object of the formation o car-body lightweight. Moreover, recently, the aluminum alloy plate is used more often also about fabricating-operation components, such as components of various transportation-by-land cars, such as automobiles other tha body sheet, and other electrical machinery and apparatus components. As such an aluminum alloy plate for fabricating operations, it is JIS of an aluminum-Mg system conventionally. 5182 alloy O material, 5052 alloy O material, etc. are used most widely.
[0003] In addition, after performing hot rolling, cold-rolling if needed further as the manufacture approach of the above aluminum-Mg system alloy plates for fabricating operations, after homogenizing to an ingot, and consider as the last board thickness, giving the last annealing may give [in / it is general and / between hot rolling and col rolling or / the halfway of cold rolling] intermediate annealing if needed in this case.
[0004]
[Problem(s) to be Solved by the Invention] Although what has reinforcement comparable [the alloy plate of an aluminum-Mg system widely used for fabricating operations] as a steel plate is obtained from the former, if the same reinforcement compares, fabricating-operation nature, especially deep drawability are inferior in the actual condition compared with a steel plate.
[0005] In the steel plate, the Lankford value (r value) is widely used from the former as an index of fabricating-operation nature, and it is supposed that fabricating-operation nature and deep drawability are excellent, so that especially an average Lankford value is high. An average Lankford value is expressed with the average of the Lankford value (r0, r45, r90) of each direction (0 degree, 45 degrees, and 90 degrees), average Lankford value = (r0+2xr45+r90) / 4, to a rolling direction here. [i.e.,]
[0006] About the steel plate for fabricating operations, the technique which raises such an average Lankford valu is established. However, the average Lankford value of an aluminum alloy plate is quite low as compared with a steel plate, and, moreover, the actual condition is that sufficient examination was not made [relation / between fabricating-operation nature and an average Lankford value] about an aluminum alloy plate in a Prior art.
[0007] Moreover, with a steel plate and an aluminum alloy plate, the crystal structure has a decisive difference, a it has face centered cubic structure with the aluminum alloy plate to generally being body-centered cubic structur in a steel plate. And although a field advantageous (111) to deep drawability appears in a rolling side in the steel plate of body-centered cubic structure, in addition, the disadvantageous (100) field for a moldability is [the field (111)] hardly formed with the subject in the recrystallization texture of the aluminum alloy plate of face centered cubic structure. then, it restricts to what the ED for the improvement in a moldability in an old aluminum alloy p lessens the disadvantageous (100) field for a moldability -- having -- **** -- so much -- coming out -- the actual condition is that sufficient improvement in a moldability was not achieved.
[0008] This invention was made against the background of the above situation, and as an aluminum alloy plate fo fabricating operations used for various transportation-by-land car components or electrical machinery and appara

components including the body sheet for automobiles etc., while it has high intensity, it aims at offering the aluminum alloy plate which was excellent in fabricating-operation nature, especially deep drawability, and its manufacture approach.

[0009]

[Means for Solving the Problem] The place where this invention person etc. repeated an experiment and examination variously in order to solve the above technical problems, By performing warm rolling suitable in the temperature region which it not only adjusts the component presentation of an aluminum alloy appropriately, but recrystallization does not produce after hot rolling usual [in the temperature region which recrystallization produces] The recrystallization texture and the average Lankford value after the last annealing can be adjusted appropriately, and it came to make a header and this invention for the aluminum plate for high intensity fabricati operations in which fabricating-operation nature, especially deep drawability were excellent with this being obtained.

[0010] Specifically the aluminum alloy plate for fabricating operations of invention according to claim 1 2.0 - 9.5 of Mg is contained, and one sort in 0.01 - 1.5% of Cu(s) and 0.05 - 2.5% of Zn or two sorts are contained, and th remainder consists of aluminum and an unescapable impurity. An average Lankford value or more by 0.75 And field diffraction intensity ratio I111 to the pure aluminium powder (111) by the X diffraction Field (200) diffract intensity ratio I200 A ratio I111 / I200 It is characterized by being 0.25 or more.

[0011] Moreover, the aluminum alloy plate for fabricating operations of invention according to claim 2 Contain 2 - 9.5% of Mg, and one sort in 0.01 - 1.5% of Cu(s) and 0.05 - 2.5% of Zn or two sorts are contained. Furthermore one sort in 0.01 - 0.7% of Mn, 0.01 - 0.3% of Cr(s), and 0.01 - 0.3% of Zr or two sorts or more are contained, and the remainder consists of aluminum and an unescapable impurity. An average Lankford value or more by 0.75 A field diffraction intensity ratio I111 to the pure aluminium powder (111) by the X diffraction Field (200) diffract intensity ratio I200 A ratio I111 / I200 It is characterized by being 0.25 or more.

[0012] And the manufacture approach of an aluminum alloy rolled plate according to claim 3 While containing 2 - 9.5% of Mg, 0.01 - 1.5% of Cu(s), One sort in 0.05 - 2.5% of Zn or two sorts are contained, and the need is accepted further. 0.01 - 0.7% of Mn, One sort in 0.01 - 0.3% of Cr(s) and 0.01 - 0.3% of Zr or two sorts or more contained. Since the remainder casts the alloy which consists of aluminum and an unescapable impurity and homogenizes to an ingot, after hot-rolling, It rolls out including warm rolling of 30% or more of reduction of sectional area at least. up to the last board thickness -- rolling out -- hitting -- the temperature within the limits of 350-100 degrees C -- Furthermore, the last annealing is performed to the rolled plate of the last board thickness. Field diffraction intensity ratio I111 to the pure aluminium powder (111) an average Lankford value is 0.75 or more, and according to an X diffraction Field (200) diffraction intensity ratio I200 Ratios I111/I200 It is characterized by obtaining 0.25 or more plates.

[0013]

[Function] The reason for definition of the alloy-content presentation in this invention is explained first.

[0014] Mg:Mg is a component element which is to the bases in the target aluminum alloy by this invention, and contributes to improvement in reinforcement and a moldability especially elongation, deep drawability, and stretchability. The amount of Mg was inferior in elongation, deep drawability, stretchability, and hole expansion property at less than 2.0%, and since rolling became difficult when exceeding 9.5% on the other hand, Mg was made into 2.0 - 9.5% of within the limits.

[0015] Since each of Cu(s), Zn:Cu, and Zn contributes to the improvement in on the strength, it adds either or bo sides. Especially Cu contributes for aging with heating at the time of paint printing among these. The effectivene of the improvement in on the strength of the amount of Cu(s) at less than 0.01% was not acquired, but since elongation and a moldability fell when the amount of Cu(s) exceeded 1.5% on the other hand, the amount of Cu(was made into 0.01 - 1.5% of within the limits. Moreover, the effectiveness of the improvement in on the strengt of the amount of Zn at least less than 0.01% was not acquired, but since elongation and corrosion resistance fell when the amount of Zn exceeded 2.5% on the other hand, the amount of Zn was made into 0.01 - 2.5% of within the limits.

[0016] Mn, Cr, Zr: Each of these is transition elements, and since they contributes to detailed-ization of a recrystallization grain, in the case of the aluminum alloy plate of invention of claim 2, they adds any one sort or t sorts or more. Since the huge intermetallic compound was generated when the effectiveness of the formation of recrystallization detailed was acquired for neither at less than 0.01%, Mn exceeded 0.7% on the other hand or Cr and Zr exceeded 0.3%, respectively, and a moldability especially hole expansion property, stretchability, bendability, and bendability especially parallel to a rolling direction were degraded, 0.01 - 0.7% and Cr made it a

0.01 - 0.3%, and Mn made Zr 0.01 - 0.3% of within the limits.
[0017] Everything but each above alloy element should just be fundamentally taken as aluminum and an unescapable impurity.
[0018] In addition, in a common aluminum alloy, Fe and Si contain as an unescapable impurity. Since Fe genera the intermetallic compound of an aluminum-Fe (-Si) system and it becomes the cause of a moldability especially elongation, bendability, and hole-expansion-property degradation, as for the amount of Fe(s), regulating to less th 0.20% is [among these] desirable. Moreover, since it becomes the cause by which Si also coexists with Fe, generates the intermetallic compound of an aluminum-Fe-Si system, and degrades a moldability especially elongation, bendability, and hole expansion property, as for Si, regulating to less than 0.20% is desirable.
[0019] Moreover, although it is independent about Ti little for ingot grain refining in a common aluminum alloy little Ti is added combining B of a minute amount, or C in many cases, adding these also in this invention is permitted. However, Ti is about 0.15%. if it exceeds -- primary phase TiAl3 since there is a possibility that a big and rough particle may arise, Ti considers as 0.15% or less -- desirable -- moreover, B -- 500 ppm big and rough it exceeds -- TiB2 since there is a possibility that the line defect by the particle may arise -- B -- 500 ppm considering as the following -- desirable -- further -- C -- 500 ppm if it exceeds, since there is a possibility that bi and rough graphite may mix -- C -- 500 ppm Considering as the following is desirable.
[0020] In addition, although Be of a minute amount is added in many cases for antioxidizing of a molten metal a the time of casting of the aluminum alloy containing Mg, the case of this invention is also 500 ppm. If it is additi of Be of the following, other engine performance will not be degraded especially.
[0021] Field diffraction intensity ratio I111 to the pure aluminium powder (111) according to an X diffraction as conditions concerning [in / furthermore / the aluminum alloy plate for fabricating operations of invention of clai 1 and claim 2] recrystallization texture Field (200) diffraction intensity ratio I200 A ratio I111 / I200 It has specified that it is 0.25 or more and that an average Lankford value is 0.75 or more. Here, a field (111) is a field advantageous to deep drawability, as already stated. On the other hand (200), although a field is a field which has detected the diffraction intensity ratio as a field equivalent to a field (100) on account of an X diffraction trial, a field (100) is a disadvantageous field for a moldability, especially deep drawability, as already stated. Therefore, ratios I111/I200 There will be so few disadvantageous (100) fields for deep drawability that it is expensive, and i will have become texture with many fields advantageous (111) to deep drawability. And the above-mentioned ra I111 / I200 Less than by 0.25, only deep drawability comparable as the conventional common aluminum-Mg system alloy plate is obtained, and deep drawability will not become good without by becoming 0.25 or more fro the former. Thus, controlling texture can be attained by performing warm rolling suitable after hot rolling so that may mention later. Moreover, an average Lankford value is also effective as an index of fabricating-operation nature, especially deep drawability, and with [an average Lankford value] 0.75 [or more], it can be said that a moldability, especially deep drawability are better than the conventional common aluminum-Mg system alloy pla Such 0.75 or more average Lankford values can also be attained by applying the manufacture process specified to claim 3 which is mentioned later.
[0022] Next, the manufacture approach of the aluminum alloy plate for fabricating operations excellent in the ab moldabilities, i.e., the manufacture approach specified by claim 3, is explained.
[0023] The molten metal of an alloy which has the above component presentations first is ingoted according to a conventional method, and it casts according to the usual casting, such as a direct chill casting process (semi-continuous casting method). It homogenizes to the obtained ingot (soaking). This homogenization is required in order to attain stabilization of the recrystallization grain at the time of the last annealing, while it equalizes the organization of an ingot and raises the moldability of the last plate. It is desirable for effectiveness with processin temperature sufficient at less than 450 degrees C not to be acquired, but for there to be fear of eutectic fusion, if 5 degrees C is exceeded on the other hand, and for effectiveness with the processing time sufficient in less than 0.5 hours not to be acquired, but for effectiveness to be saturated, and to only spoil profitability, if 24 hours is exceeded, therefore to consider as the conditions of 0.5 - 24 hours in 450-570 degrees C, although especially the conditions of homogenization are not limited.
[0024] It hot-rolls after homogenization. That what is necessary is just to perform this hot rolling according to a conventional method, even if it carries out promptly after homogenization, it reheats, once it cools after homogenization, and you may carry out. In addition, hot rolling means rolling in the temperature region more tha recrystallizing temperature, therefore rolling accompanied by recrystallization here. Therefore, rolling in the hot temperature region usually exceeding 350 degrees C is meant.
[0025] After hot rolling, in order to consider as the predetermined last board thickness, it rolls out further, but it i

important to perform warm rolling in the temperature within the limits of 350-100 degrees C by 30% or more of reduction of sectional area especially in this invention in order to obtain the above recrystallization texture. That it is said ratio I111 / I200 by the next last annealing by performing rolling without recrystallization in a 350-100-degree C temperature region 30% or more. The plate excellent in the deep drawability which has 0.25 or more recrystallization texture can be obtained.

[0026] Here, the temperature of warm rolling is about 350 degrees C. If it becomes the elevated temperature to exceed, recrystallization arises during rolling and there is little growth of field (111) bearing at the time of the las annealing. On the other hand at less than 100 degrees C, cold-working distortion increases, and the recrystallizati whose field (100) bearing is a subject arises at the time of the last annealing. Growth of field (111) bearing at the time of the last annealing has little at least less than 30%, therefore, in any case, the reduction of sectional area in the temperature within the limits of further 350-100 degrees C is a ratio I111 / I200. A value cannot obtain the recrystallization texture excellent in 0.25 or more deep drawability. In addition, as for especially this warm rollin it is desirable to also perform within the limits of 350-100 degrees C at the temperature within the limits of 350-2 degrees C, and growth of field (111) bearing at the time of the last annealing becomes remarkable especially at th temperature within the limits which are 350-200 degrees C.

[0027] In addition, controlled cooling may be performed and you may roll out by warm rolling in the temperatur within the limits of the above 350-100 degrees C, i.e., rolling without recrystallization, as warm rolling succeedingly so that you may carry out by reheating anew after termination of the hot rolling accompanied by recrystallization (after cold-rolling further so that it may mention later depending on the case) or it may become t temperature after the last recrystallization termination and within the limits of 350-100 degrees C in the same hot rolling mill.

[0028] In addition, what is necessary is just to, perform 30% or more of warm rolling in a 350-100-degree C temperature region without the recrystallization above again in short between the hot rolling accompanied by recrystallization, and the last annealing for the recrystallization to the rolled plate used as final board thickness, a it may cold-roll combining warm rolling depending on the last board thickness to wish. That is, the last annealing may be given, whether it cold-rolls after performing warm rolling after hot rolling, and performs only warm rolli between hot rolling and the last annealing or gives the last annealing after that, or after once cold-rolling and performing warm rolling after that after hot rolling further. However, since there is a possibility of cold rolling becoming easy to cause a field (100) bearing subject's recrystallization in the last annealing, and having an adver effect on deep drawability, even when cold-rolling, as for the reduction of sectional area, it is desirable to make i small as much as possible, and it is usually taken as 50% or less of rate of cold rolling.

[0029] In addition, after the hot rolling accompanied by the above recrystallization, generally for the reason on a rolling disposition, the roll turner of a before [the last annealing] performs intermediate annealing to inside in many cases, but since warm rolling is performed between them in this invention, there is little need of performing intermediate annealing. However, intermediate annealing may be performed depending on the case, and the halfway of cold rolling is [halfway any are sufficient as this intermediate annealing before warm rolling and the back (before cold rolling), and] sufficient as it further. Although especially the conditions of intermediate annealing performed if needed are not limited, in the case of intermediate annealing of a batch type, it considers heating maintenance of 0.5 - 24 hours at 250-450 degrees C, and, in the case of intermediate annealing of a continuous-annealing method, it is desirable to have no maintenance at 350-580 degrees C or to consider as the maintenance for 5 or less minutes. In the case of intermediate annealing of a batch type, there is effectiveness of intermediate annealing with annealing temperature sufficient at less than 250 degrees C or a possibility of spoilin profitability if a recrystallization grain will make it big and rough, a moldability will fall, effectiveness in less tha 0.5 hours with still more sufficient annealing time amount will not be acquired if it is not obtained but 450 degre C is exceeded, but 24 hours is exceeded on the other hand. On the other hand, if in the case of intermediate annealing of a continuous-annealing method a recrystallization grain will make it big and rough, a moldability w fall, if effectiveness with temperature sufficient at less than 350 degrees C is not acquired but 580 degrees C is exceeded, and the holding time exceeds 5 minutes further, there is a possibility that a recrystallization grain may make it big and rough, and a moldability may fall.

[0030] The last annealing for making it recrystallize eventually and raising a moldability is given to the rolled pl which performed warm rolling after hot rolling as mentioned above, and was made into the last board thickness, the rolled plate (the case where intermediate annealing is given is included) made into the last board thickness combining warm rolling and cold rolling. As this last annealing already described, it is I111 / I200. The recrystallization texture where a value is advantageous to 0.25 or more moldabilities, especially deep drawability

can be obtained, and an average Lankford value can be made or more into 0.75.
[0031] As for the conditions of the last annealing, it is desirable it to be desirable to consider as maintenance of 0 - 24 hours at 250-450 degrees C in the case of annealing of a batch type, and to have no maintenance at 350-580 degrees C, when it is a continuous-annealing method, or to consider as the maintenance for 5 or less minutes. Sin temperature does not recrystallize at less than 250 degrees C in the case of the last annealing of a batch method, a good moldability is not obtained, but if 450 degrees C is exceeded, a recrystallization grain will make it big and rough, surface deterioration occurs, and a poor appearance is produced, and a moldability also falls, the thickness a scaling layer increases further and chemical conversion nature falls. In addition, as a rule of thumb of big-and-rough-izing of a recrystallization grain, when recrystallization particle size is set to 150 micrometers or more, it c be said to be big and rough-ization here, and this is the same also for the case of the last annealing by the continuous-annealing method mentioned later. Moreover, if recrystallization does not fully advance [the holding time in the last annealing of a batch method] in less than 0.5 hours but 24 hours is exceeded, it not only spoils profitability, but the thickness of a scaling layer will increase and chemical conversion nature will fall. On the oth hand, since temperature does not fully recrystallize at less than 350 degrees C in the case of the last annealing of continuous-annealing method, a good moldability is not obtained, but if 580 degrees C is exceeded, a recrystallization grain will make it big and rough, and surface deterioration arises, and it becomes poor [an appearance], and a moldability also falls, the thickness of a scaling layer increases further and chemical convers nature also falls. Moreover, if the holding time of intermediate annealing by the continuous-annealing method exceeds 5 minutes, the thickness of a scaling layer will increase and chemical conversion nature will fall.
[0032]
[Example] Each alloy of the component presentation shown in the alloy signs A, B, and C of a table 1 was ingote according to the conventional method, and it cast by the usual direct chill casting process to the ingot with the thickness of 550mm, a width of face [of 1500mm], and a die length of 4000mm. In addition, each alloys A, B, a C are alloys of component presentation within the limits altogether specified by this invention, and especially the alloy A is an alloy equivalent to JIS5182 before long.
[0033] After homogenizing the obtained ingot for 500 degree-Cx 10 hours, it hot-rolled according to the conventional method, and considered as the hot-rolling plate of 4mm of board thickness. In addition, about 490 degrees C and the hot rolling termination temperature of hot rolling initiation temperature are about 330 degrees The hot-rolling plate of 4mm of board thickness after hot rolling was processed on condition that versatility as shown in the manufacture process numbers 1-8 in a table 2. That is, warm rolling or cold rolling was performed, both warm rolling and cold rolling were performed, and about the part [further], the roll turner gave intermediat annealing and gave the last annealing to the rolled plate of the obtained last board thickness (1.0mm) in inside.
[0034] In addition, in a table 2, the manufacture process numbers 1 and 2 should set the example of this inventio and the manufacture process number 3 which performed only warm rolling of condition within the limits which each specifies by this invention between hot rolling and the last annealing to the halfway of warm rolling. Since example of this invention and the manufacture process number 4 which performed intermediate annealing cold-r first to the hot-rolling plate of 4mm of board thickness, warm rolling is performed. And the example of this invention which performed intermediate annealing in the halfway of warm rolling, the example of a comparison which the manufacture process number 5 only cold-rolled, The manufacture process numbers 6 and 7 are the examples of a comparison which cold-rolled after performing warm rolling by the example of a comparison whic performed only warm rolling which separated from the warm-rolling temperature requirement specified by this invention, and the reduction of sectional area which separates from the rate conditions of warm rolling of specify the manufacture process number 8 by this invention further. Moreover, as for the manufacture process number 2, the last annealing applied annealing using the salt bath as annealing by which the manufacture process numbers 1 3-8 are all equivalent to continuous annealing in annealing of a batch type again.
[0035] Field diffraction intensity ratio [further as opposed to / while performing a tension test to a rolling directi and investigating the mechanical property of a rolling direction about the plate after the last annealing obtained a mentioned above, investigate an average Lankford value, an Erichsen value, and LDR (marginal contraction ratio as moldability assessment, and / pure aluminium powder (111) by the X diffraction] I111 Field (200) diffraction intensity ratio I200 A ratio (reverse pole integrated-intensity ratio) I111 / I200 It investigated. These results are shown in a table 3.
[0036]
[A table 1]

h g cg b eb cg e e

表　1

合金符号	化学成分 (wt%) Mg	Cu	Zn	Mn	Cr	Zr	Fe	Si	Al	備考
A	4.48	0.04	−	0.36	−	−	0.25	0.11	残	JIS 5182 相当
B	5.71	0.33	0.08	0.12	0.05	0.02	0.11	0.11	残	
C	5.18	−	0.21	−	−	−	0.15	0.08	残	

[0037]
[A table 2]

表　2　　製造プロセス

製造プロセス番号	温間圧延 開始板厚(mm)	上り板厚(mm)	圧延率(%)	圧延温度(℃)	冷間圧延 開始板厚(mm)	上り板厚(mm)	圧延率(%)	中間焼鈍 焼鈍時板厚(mm)	条件	最終焼鈍条件	区分
1	4.0	1.0	75	250	−	−	−	−	−	350℃×2hr	発明プロセス
2	4.0	1.0	75	250	−	−	−	−	−	550℃×5sec ソルトバス	〃
3	4.0	1.0	75	250	−	−		2.0	350℃×2hr	350℃×2hr	〃
4	2.5	1.0	60	250	4.0	2.5	37	2.0	350℃×2hr	350℃×2hr	〃
5	−	−	−	−	4.0	1.0	75	−	−	350℃×2hr	比較プロセス
6	4.0	1.0	75	390	−	−	−	−	−	350℃×2hr	〃
7	4.0	1.0	75	85	−	−	−	−	−	350℃×2hr	〃
8	4.0	3.0	25	250	3.0	1.0	67	−	−	350℃×2hr	〃

[0038]
[A table 3]

h　　g　cg b　　eb cg　e e

表　3　　機械的性質、成形、および集合組織

合金符号	製造プロセス番号	機械的性質			成形性			I_{111}/I_{200}	区分
		引張強さ (N/mm²)	耐力 (N/mm²)	伸び (%)	平均ランクフォード値	エリクセン値	LDR		
A	1	280	138	29	1.10	9.8	2.19	0.48	本発明例
A	2	279	139	32	1.18	9.9	2.17	0.53	〃
A	3	276	135	31	1.11	9.8	2.15	0.41	〃
A	4	288	143	28	0.99	9.7	2.15	0.38	〃
A	5	291	144	26	0.64	9.4	2.11	0.12	比較例
A	6	281	136	27	0.71	9.5	2.12	0.09	〃
A	7	287	142	26	0.66	9.3	2.10	0.10	〃
A	8	285	140	28	0.74	9.6	2.14	0.20	〃
B	1	302	157	35	1.28	10.7	2.22	0.59	本発明例
B	2	298	143	36	1.32	10.7	2.20	0.63	〃
B	4	301	155	35	1.24	10.5	2.18	0.51	〃
B	5	305	162	33	0.70	9.7	2.14	0.09	比較例
B	8	300	154	34	0.72	9.7	2.16	0.18	〃
C	1	295	147	35	1.36	10.8	2.20	0.65	本発明例
C	2	294	143	34	1.38	10.8	2.19	0.66	〃
C	5	299	150	31	0.68	9.8	2.12	0.08	比較例
C	8	293	144	32	0.71	9.7	2.13	0.15	〃

[0039] At the temperature requirement specified by this invention so that clearly from a table 3, and the example this invention which performed warm rolling which fills reduction of sectional area, it is all I111 / I200. It is clea that a value becomes 0.25 or more, and have recrystallization texture advantageous to a moldability, especially d drawability, and an average Lankford value also becomes 0.75 or more, and an Erichsen value, the moldability evaluated by LDR, especially drawability are excellent. On the other hand, when it is each example of a compari to which warm rolling which fulfills the temperature requirement conditions specified by this invention and reduction-of-sectional-area conditions was not carried out, it is all I111 / I200. Recrystallization texture advantageous to deep drawability was not generated less than by 0.25, but moreover, an average Lankford value also less than 0.75, and the value was inferior also in an Erichsen value and the deep drawability evaluated by LD

[0040]
[Effect of the Invention] While it has the high intensity with which the aluminium alloy plate for fabricating operations of invention of claim 1 and claim 2 is required of the automobile body etc. as clear also from the abov example as an aluminum-Mg system aluminium alloy plate, a moldability, especially deep drawability are remarkably excellent also in ******. Moreover, according to the manufacture approach of the aluminum alloy pl for fabricating operations invention of claim 3, the aluminum alloy plate which a moldability, especially deep drawability are remarkable as mentioned above, and was excellent can be obtained in practice and easily.
[0041] In addition, although the aluminium alloy plate by this invention is the the best for the components of various transportation-by-land cars, such as the automobile body, it is natural. [of the ability to be used for the application for the chassis of various electrical machinery and apparatus, a panel, and various kinds of other fabricating operations]

[Translation done.]

h　　g　cg b　　eb cg e e